

MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for October, 1898, is based on about 2,940 reports from stations occupied by regular and voluntary observers, classified as follows: 147 from Weather Bureau stations; numerous special river stations; 32 from post surgeons, received through the Surgeon General, United States Army; 2,583 from voluntary observers; 96 received through the Southern Pacific Railway Company; 29 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 31 from Canadian stations; 20 from Mexican stations; 7 from Jamaica, W. I. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Dr. Mariano Bárcena, Director of the Central Meteorological and Magnetic Observatory of Mexico; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kim-

ball, Superintendent of the United States Life-Saving Service; and Commander J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to generally conform to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

During the last two days of September, 1898, a storm developed in the vicinity of the island of Santo Domingo, and moved thence northwestward to the south Atlantic coast of the United States, where it raged with hurricane violence during October 2. A detailed account of this disturbance, and of the action of the Weather Bureau in issuing warnings of its approach is given in the description of the storm which follows, and its track is plotted on Chart II.

Conservative estimates place the damage caused by this storm in Georgia and Florida at \$1,500,000. The value of vessels and cargoes detained by the Weather Bureau warnings of Saturday, October 1, was \$380,000, and the crews numbered 56. These were sailing vessels and would doubtless have suffered the fate of those caught at sea. At Savannah the warnings prompted active measures for the protection of shipping and merchandise, and credit is given the warnings by representatives of business and marine interests, for a saving of many thousands of dollars. At Charleston vessels and cargoes valued at nearly \$1,000,000, remained in port.

Two storms of unusual severity crossed the upper lakes, one on the 17th and 18th, and the other on the 25th and 26th; on the lower Lakes the severest storm of the month occurred on the 26th and 27th.

No wind storms of marked severity occurred on the Pacific coast during October, 1898.

THE WEST INDIAN HURRICANE OF SEPTEMBER 29-OCTOBER 2.

The Weather Bureau West Indian reports of September 28, 1898, indicated the formation of a cyclonic storm in the neighborhood of Puerto Rico, and during September 29 the circulation of the winds, the character and movement of the clouds, and the action of the barometer showed that the central area of the disturbance had moved to a position off the northern coast of Santo Domingo. During September 30 the center moved north of west over the old Bahamas Channel and began to recurve northward. Conforming to one of the laws of cyclonic disturbances the storm-center deepened during the recurve, and by the morning of October 1 its influence had extended to the Florida coast. Advisory messages were sent to south Atlantic ports at 9:50 a. m., giving the position of the storm and stating that high north to northeast winds would prevail along those coasts. Special noon and 3 p. m. observations showed that the center of disturbance was approaching our southeastern coasts. Storm northeast signals were ordered from Key West to Norfolk, and the following warning was communicated to the Bureau of Navigation, Navy Department, Washington, the New York and Philadelphia Maritime Exchanges, and generally to Atlantic coast and east Gulf maritime interests:

Storm approaching the Florida coast near Jupiter. Dangerous shift-

ing gales indicated for Florida coasts, and northeast gales as far north as Norfolk.

By the evening of October 1 the storm center had moved to a position about 150 miles to the northeastward of Jupiter and was apparently moving in a northwesterly direction. During the night of October 1 the storm was deflected to a more westerly course by an extensive area of high barometer which occupied the Atlantic coast districts to the northward of its position, and, following a law previously referred to, it increased in intensity, until, by the morning of October 2, when it was central off the coast northeast of Jacksonville, Fla., it had acquired hurricane strength. Immediately following the receipt of the morning reports on October 2, the following message was telegraphed to all south Atlantic ports and to the Navy Department, the maritime exchanges, and all interests, both marine and land, which were subject to injury by hurricanes:

Hurricane off the northeast point of Florida will move north and cause northeast hurricane winds on the South Atlantic coast this afternoon, and to-night on the Middle Atlantic coast.

Advisory messages were sent to middle and east Gulf coasts, and all authorized means were used to disseminate throughout the threatened districts information regarding the hurricane. The storm center crossed the coast line about midway between Jacksonville and Savannah, in the neighborhood of 11 a. m. of October 2, and the character of its action during that day is indicated by the following reports:

A. J. Mitchell, section director, Weather Bureau, Jacksonville, Fla.:

The barometer fell rapidly during the day and night of October 1, and reached a minimum of 29.07 at 11 a. m. of the 2d. The storm center appeared to pass north and east of Jacksonville, probably 50 to 60 miles distant. The maximum wind velocity, 60 miles an hour, occurred about 11:10 a. m., 2d. Information signals were hoisted at 1 p. m., of the 1st, and northeast storm signals were displayed at 4 p. m. of the 1st, and at 7 a. m. of 2d hurricane signals were hoisted. As the storm approached from the southeast no serious damage was done to coast districts south of Mayport; at Mayport and Pablo flood damages amounted to several thousand dollars. In Jacksonville damages will not exceed \$5,000, the small loss being due, in a great measure, to the timely warnings of the Bureau, and also to the fact that the highest winds were from a westerly direction. The coast district from Mayport to Fernandina suffered heavily, in fact Fernandina was nearly destroyed. Great damage was caused on the coast near and south of Everet. On the south Georgia coast the wind was from the northeast, and the sea flooded level lands, destroying crops and stock and imperiling lives. From Savannah to St. Augustine all telegraph lines were prostrated and many miles of railroad track washed away. At Fernandina boats at anchor foundered or were blown into the marshes. A conservative estimate of the damage in Florida by this storm is \$500,000.

It is a pleasure to report that the Bureau effectively reduced the losses of both property and life by warnings. Vessels that would have sailed Saturday from the several Florida ports numbered ten or more, and, as they were sailing craft, they would have suffered the fate of those caught at sea. The value of the vessels and cargoes detained was \$380,000, and the crews numbered 56.

H. B. Boyer, Observer, Weather Bureau, Savannah, Ga.:

The most of the damage sustained in the vicinity of Savannah was caused by the backing up of the water by the southeast hurricane winds blowing against the Gulf Stream. Cotton warehouses and naval stores yards were flooded to a depth of several feet, and merchandise stored under sheds was damaged by heavy rain. It is impossible to make an estimate of the loss along the city wharves, but it was quite heavy. About 5,000 barrels of rosin were floated and badly scattered, and it is estimated that 60,000 bushels of rice, valued at about \$60,000, were washed away. The conditions along the Ogeechee were fully as bad as along the Savannah, Mr. W. G. Morrill, who represents three-fourths of the rice planting interests in this section, stating that his losses from the two storms (August 30-31 and October 1-2) amounted to \$350,000, which represents value of life and live stock destroyed. He also states that 97 negroes were drowned upon the plantation which he represents.

Hutchinsons Island, opposite Savannah, was completely overflowed to a depth of 4 to 8 feet, the salt water stretching back over the rice plantations in South Carolina to the pine ridges, about 3 miles to the northeast of Savannah. All the lowland to the eastward of Savannah was submerged.

At Thunderbolt, about 6 miles from Savannah, and on the Wilmington River, one life was lost. Small sailing craft were sunk or blown into the marshes, and wharves were damaged; the property loss being estimated at \$3,000 to \$5,000. At the Isle of Hope the water rose 15 feet, washing away bath-houses and boat-houses. Down the Savannah River wharves and oil houses were washed away. At Quarantine station the wharves were badly damaged, and the British steamer *Syanara*, and the schooners *Fannie L. Childs* and *Millville*, and the Italian bark *Franklyn* were blown ashore. The loss to wharves and tramway was \$3,500. At Tybee Island Mr. Lovell's house was blown away, and at the fort about 2½ feet of sand piled up inside the works. The Tybee railroad was badly washed. At Warsaw the barracks were washed out, and a depth of 4 feet of water was reported in the magazine. The Sea Islands off the Carolina coasts escaped severe injury, although the tide was very high and the wind heavy. At Beaufort the water came up into the streets. At Port Royal, S. C., the damage was slight. At the naval station considerable sand was washed into the dry dock. The greatest loss was sustained south of Savannah and nearer the storm center. Great havoc was caused at Brunswick, where a conservative estimate places the losses at \$500,000. Nearly every business house and warehouse in the city was flooded. At noon, on the 2d, the principal residence and business thoroughfares were 4 to 8 feet under water. Nearly all docks suffered from lifting; one to two hundred thousand feet of lumber and hundreds of barrels of naval stores were washed away, and five vessels were washed ashore. At New Town, records kept by the family of Egbert Dart, show that not since 1812 has such a flood been known in that section.

Campbell Island, 12 miles from Darien, on the Attahama, was swept by water, and all of its inhabitants, except three, were drowned—not less than 20 and perhaps 50. At Darien there were 31 persons drowned and 1 killed, and the loss to rice, stock, lumber, vessels, etc., aggregated \$350,000. The height of the tidal wave at that place was about 13 feet above mean high water mark, inland, and 18 feet at Sapels Light-house.

The property damaged at Brunswick, Darien, and the surrounding country, is estimated at \$1,000,000, and the loss in the State is incalculable.

At Savannah the information signal was ordered at 10:20 a. m. of October 1, and storm northeast signals at 4:30 p. m. Every effort was made to disseminate the warnings. The storm winds began 2:30 a. m. of September 2, and continued until 11:50 p. m. of that date, with a maximum velocity of 60 miles per hour from the northeast at 11:30 a. m. No damage was sustained by the shipping in port. The Savannah Morning News of October 3 remarked as follows in connection with the work of the Weather Bureau: "To these (Weather Bureau) warnings the safety of the shipping in the harbor was due. * * * Every precaution had been taken to warn shipping circles and considerable damage was averted by the advice from the Capital."

Mr. Boyer cites many highly commendatory statements by representatives of the maritime and business interests of Savannah and vicinity, wherein a saving of many thousands of dollars is shown to have resulted from precautionary measures, which were based upon advices received from the Weather Bureau.

L. N. Jesunofsky, Local Forecast Official, Charleston, S. C.:

The order to hoist storm northeast signals was received 6:07 p. m. 1st, and the information the accompanying message contained regarding the approaching storm was given the widest distribution. Very little damage was caused in Charleston and vicinity, although damage was caused to sailing craft and a number of persons were drowned along the South Carolina coast.

Mariners were all warned on Saturday, the day preceding the storm, that navigation would be dangerous within the following forty-eight hours, and vessels and cargoes to the value of nearly \$1,000,000 were detained in port, and many tugs, schooners, barks, brigs, and steam vessels were taken up the Ashley and Cooper rivers late Saturday and early Sunday to avoid the high seas. Rice planters lost heavily from the high tides, and the sea-island cotton growers had their crops injured by sea spray.

After the 2d the storm passed inland and lost force rapidly.

FROST WARNINGS.

The morning of October 21 warnings of frost were telegraphed to points in Texas, Louisiana, Arkansas, Mississippi, Alabama, western Tennessee, western Kentucky, and the interior of western Florida, and on the morning of October 22, 1898, reports warranted the issue of the following special bulletin from the Central Office at Washington:

This morning's reports show frosts generally throughout the infected